Number 20 Series 1925

UNITED STATES DEPARTMENT OF AGRICULTURE
BUREAU OF CHEMISTRY AND SOILS
In Cooperation with the Iowa Agricultural Experiment Station

SOIL SURVEY
OF
CLAYTON COUNTY, IOWA

BY

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SOIL SURVEY OF CLAYTON COUNTY, IOWA

By T. H. BENTON, Iowa Agricultural Experiment Station, in Charge, and A. L. GRAY, U. S. Department of Agriculture

COUNTY SURVEYED

Clayton County is in the northeastern part of Iowa. It is removed on the north, by one tier of counties, from the Minnesota State line, and on the east it extends to Mississippi River, which is also the State boundary. The total land area is 784 square miles or 501,760 acres.

Clayton County has two main topographic divisions. The first, which includes the entire county with the exception of a small area in the southwestern corner, has a surface configuration resulting from erosion of nearly horizontal rock strata of varying degrees of hardness. The second, including the southwestern corner, has a smooth constructional surface, having been shaped by the Iowan glaciation.

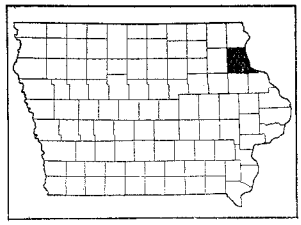

FIGURE 1.—Sketch map showing location of Clayton County, Iowa

The first of these topographic divisions includes the driftless area of the county. This region was not overrun by the ice sheet which so greatly modified the relief in other parts of the State. With this division is also included the area covered by the Kansan drift sheet, as the material left by the ice is so thin that it has not materially changed the broad surface features.

The most prominent features of that part of the county modified by erosion are the deep, sharply cut valleys of the Mississippi River and the lower stretches of its larger tributaries in the county. These valleys have been carved from 500 to 600 feet below the general level of the upland.

Mississippi River Valley is 1¼ miles wide from cliff to cliff, and the channel winds from side to side across the flood plain. The bluffs in places rise abruptly to a height of 300 or 400 feet above the flood plain, and from this height the slope has a more gradual ascent to 600 or more feet above the river. For some distance above and below McGregor and also in the vicinity of Guttenberg limestone cliffs rise abruptly and are a striking feature of the valley. These cliffs stand from 50 to 100 feet high, with the talus slopes at their bases and the more moderate slopes above. Where the strata are not exposed to form these rocky walls, the slopes though steep are covered for the most part by a heavy growth of timber.

This rugged relief is seen only in a strip several miles wide that follows the Mississippi River. All the tributary streams running

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across this strip occupy deep narrow valleys. The valleys of Turkey and Volga Rivers have been cut to a depth of 400 or 500 feet, and in places the flood plain is one-half mile wide. Cliffs stand out on the steep slopes at many places, with occasional isolated turrets or castlelike forms. Toward the western part of the county where these streams flow through soft shale, the valleys are wider and the slopes smoother. A prominent feature of the topography is the high ridge between Turkey and Volga Rivers, which has a width of about 2½ miles between Osborne and Elkader and reaches a height of 450 feet above the adjacent streams.

The valley of Bloody Run extends 10 miles through a narrow steep-sided gorge from 300 to 400 feet deep. The main line of the Chicago, Milwaukee, St. Paul & Pacific Railroad follows this gorge in climbing from the flood plain of Mississippi River to the upland 650 feet above.

The region north and east of Turkey Valley is made up of a succession of broad, gently rolling divides separated by stream valleys. South of Volga and Turkey Rivers for several miles the country is rough and dissected by many streams which cut their valleys across a limestone escarpment. The steep slopes are wooded and covered by blocks of limestone that have broken off and tumbled down from above.

The second topographic division is the Iowan drift plain which occupies parts of Cass and Lodomillo Townships. Its constructional surface is in marked contrast to that of the remainder of the county, as it has had the smoothing effect of the accumulation of drift instead of being acted on by erosion. The border of the Iowan drift follows very closely the course of the Chicago, Milwaukee, St. Paul & Pacific Railroad northwestward to Strawberry Point. Northwest of that place the drift boundary lies more than 2 miles north of the railroad. This region is marked by broad hills or ridges of drift rising 50 or 60 feet above the general level of the drift plain.

With the exception of a few heads of drainage on the northern and eastern border of the county that empty into Yellow River in Allamakee County, itself a tributary of the Mississippi River, a few short, intermittent branches that empty directly into the Mississippi River, and a half dozen small streams in the Iowan drift section, the drainage of the county empties into one of five streams discharging into the Mississippi River and all located within the county. Except in the Iowan drift where drainage is poor, the whole area of the county is well dissected. Every farm is provided with adequate drainage. The run-off is excessive in all parts of the county except in the southwest corner and the "Garnavillo prairie," but even this area is well drained. The majority of the streams are still cutting down.

Water power in this county was first developed to operate gristmills and flour mills to grind corn and locally grown wheat. Since the increase and improvement of transportation facilities and the abandonment of wheat growing, gristmills and flour mills have ceased operation. A mill at Elkader, run by electric power from the dam that once operated the mill, is now used to grind feed. This dam furnishes power for nearly the whole county. Many

lines have been built to provide farmers with light and power. A proposed site for a 20-foot dam is located about 10 miles below Elkader. This dam will be built when the market for power is developed. A small hydroelectric power plant located at Volga supplies the surrounding territory. It is hooked up with the one at Elkader.

Clayton County has an elevation ranging from about 600 feet above sea level in Mississippi Valley, near North Buena Vista, to about 1,250 feet at several high points on the upland. Elkader, near the center of the county, has an elevation of 759 feet and Strawberry Point, on one of the highest ridges, of 1,216 feet above sea level. Guttenberg, in the Mississippi River Valley, lies about 600 feet above sea level.

The second settlement in Iowa was made in 1795 near where McGregor is now located. Other French settlements were along the river, but there was very little agricultural development by the pioneers. After 1830 settlers began to come from the Eastern States and the agricultural development began. Later a small percentage of foreign immigrants came to the county. The population of the county is now 25,032 and has been nearly stationary for a number of years.

Chicago, Minneapolis, and St. Paul are the principal markets for livestock and other agricultural products of the county. A small proportion of the livestock, however, is shipped to local packing houses at Mason City and Dubuque. No large towns have been built in Clayton County, but a number of small towns serve as shipping points. Guttenberg in 1920 had a population of 1,666, Elkader, the county seat, of 1,223, Strawberry Point of 1,101, and McGregor of 1,289. A number of smaller towns and villages are scattered over the county.

Clayton County is served by lines of the Chicago, Milwaukee, St. Paul & Pacific Railroad system. Three main highways cross the county. These roads have been well graded and are partly graveled. Most of the other public roads are graded and are rapidly being improved.

CLIMATE

Clayton County has a climate favorable to the production of all the staple crops of the region. Of the mean annual precipitation of 34.36 inches, about 70 per cent falls in the growing season from April to September, inclusive. The average date of the last killing frost is May 3 and of the first is October 3, giving an average frost-free period of 153 days. Through a period of years the latest frost recorded occurred on May 27 and the earliest on September 13.

Table 1 gives the more important climatic data, as compiled by the Weather Bureau station at Postville, Allamakee County, just outside the northwest corner of Clayton County. No official data on climate have been collected in Clayton County.

TABLE 1.—*Normal monthly, seasonal, and annual temperature and precipitation at Postville, Allamakee County*

[Elevation, 1,192 feet]

Month	Temperature			Precipitation			
	Mean	Absolute maximum	Absolute minimum	Mean	Total amount for the driest year, (1910) [1]	Total amount for the wettest year, (1902)	Snow, average depth
	° *F.*	° *F.*	° *F.*	*Inches*	*Inches*	*Inches*	*Inches*
December	21.4	57	−25	1.46	0.70	2.44	6.7
January	14.4	56	−35	1.16	1.85	.85	9.0
February	17.7	54	−30	1.14	.99	1.97	7.5
Winter	17.8	57	−35	3.76	3.54	5.26	23.2
March	30.6	84	−18	1.91	.01	2.73	6.3
April	46.6	89	10	2.98	2.91	1.36	2.1
May	58.7	90	22	5.30	3.94	18.04	.2
Spring	45.3	90	−18	10.19	6.86	22.13	8.6
June	66.6	96	36	4.41	2.56	6.55	.0
July	71.7	108	45	4.52	.76	10.70	.0
August	69.2	97	37	3.56	3.03	1.98	.0
Summer	69.2	108	36	12.49	6.35	19.23	.0
September	61.1	97	26	3.69	4.81	4.61	Trace.
October	49.1	84	16	2.58	.96	1.33	.6
November	33.3	74	−8	1.65	.35	2.15	3.1
Fall	47.8	97	−8	7.92	6.12	8.09	3.7
Year	45.0	108	−35	34.36	22.87	54.71	35.5

[1] Same yearly precipitation occurred also in 1895.

AGRICULTURE

The agricultural history of Clayton County began soon after 1830. The census of 1833 showed a population of 27 for the county. Early crops are said to have been uncertain, as the corn grown was not acclimated and failed to ripen, but in a few years satisfactory varieties were developed. Wheat was an important crop with the early settlers, and large yields were obtained on the virgin soils. The produce of the early settlers was shipped by boat to towns along the Mississippi River. The changes in agriculture which took place between 1830 and 1880 were mainly in a shifting of the areas devoted to certain crops. The acreage in corn gradually increased. Dairying became more important, and butter was shipped out by river boats. The percentage of land in wheat, as compared to that in other crops, decreased, but the total acreage did not decrease as new land was brought under cultivation. The changes which have taken place in the acreage and production of the leading crops of the county since 1879 are shown in Table 2, based on records compiled by the Federal census.

TABLE 2.—*Acreage and production of leading crops in 1879, 1889, 1899, 1909, 1919, and 1924*

Year	Corn		Oats		Wheat		Barley		Hay	
	Acres	*Bushels*	*Acres*	*Bushels*	*Acres*	*Bushels*	*Acres*	*Bushels*	*Acres*	*Tons*
1879	62,247	2,618,851	26,920	885,368	78,462	735,780	5,272	106,169	38,282	51,514
1889	66,605	2,680,498	57,476	2,093,426	14,018	180,398	4,871	145,099	53,047	85,120
1899	82,599	3,607,270	72,062	3,782,010	10,096	132,750	8,050	246,350	[1] 54,172	75,616
1909	76,667	3,101,830	59,507	1,823,182	2,312	44,571	18,717	383,698	[1] 139,019	241,844
1919	69,360	3,395,631	62,720	2,261,156	7,262	113,384	7,716	185,110	[1] 76,647	167,773
1924	56,286	1,545,399	71,552	3,045,792	1,800	52,105	2,508	85,098	72,010	109,789

[1] Hay and forage.

Minor crops produced in varying quantities from year to year are flax, rye, and potatoes. The most striking change in the agriculture of the county is the gradual decline of the wheat acreage. Since 1879, this crop has fallen from first place in acreage to an almost negligible position. The war demand caused a slight increase in production, as is shown by the census of 1919, but this gain was quickly lost.

At the present time, agriculture consists of the production of grain and hay, the greater part of which is for home use. The raising and feeding of cattle and hogs and dairying are the principal livestock industries. Sufficient garden truck and fruit are raised to supply home and local needs.

Farming activities center largely around the production of corn. This is the principal crop on all soils of the county, but the dark silt loam members of the Tama and Judson series are especially adapted to it. Nearly the entire crop is fed on the farms to work animals, beef cattle, hogs, and dairy cows. The most common varieties are Reid Yellow Dent, Silver King, Wimple Yellow Dent, Minnesota 13, and a local variety known as Early Yellow Dent. The 1925 census shows that in 1924 about 66 per cent of the corn crop was harvested for grain, 14 per cent was cut for silage and fodder, and the remainder was hogged off.

In the southeastern part of the county sweet corn is grown on more than a thousand acres. This crop is largely marketed at a cannery at Cassville, Wis.

Oats have for many years ranked next to corn in importance. On many farms oats are grown alternately with corn. Most of the oats grown are of the earlier varieties, mainly Albion (Iowa 103), Richland (Iowa 105), Silvermine, Iowa Champion, and Early Yellow. Practically all the crop is threshed for grain and fed on the farm, except in the southern part of the county where some grain is sold.

Hay is produced only for home consumption. Of the 72,010 acres of land in hay crops in 1924, 47,556 acres were in clover and timothy mixed, 8,653 acres in timothy alone, 13,039 acres in red, alsike, and mammoth clover, and 1,045 acres in alfalfa. The clover and timothy are usually sown with oats, which acts as a nurse crop.

Soybeans have grown in favor with the farmers during the last five years. They are commonly sown with corn for silage and hogging down and some are grown for seed. Vetch, Sudan grass, millet,

rape, and Canadian and field peas are all grown to some extent. Considerable sorghum is grown for sirup.

Alfalfa produces well in the greater part of the county. Its small acreage may be accounted for by the fact that it does not fit in well with the system of farming followed. Clover, which is more easily grown, takes the place of alfalfa as a legume.

Potatoes have never been grown on a commercial scale, but the farmers plan to grow sufficient to supply home needs and the local market. Early Ohio, Rural New Yorker, Irish Cobbler, and Early Rose are the varieties grown. Potatoes are grown most extensively near Edgewood, Strawberry Point, and Volga, and in Mallory Township.

Fruit growing has not been increased to the stage of commercial importance, but small orchards on many farms supply home needs. The success of growers with apples, grapes, and small fruits in the eastern part of the county indicates that the fruit-growing industry could be profitably extended. The varieties of apples that do well are the Northwestern Greening, Oldenburg (Duchess of Oldenburg), Whitney, Mammoth Blacktwig, Winesap, Tolman Sweet, and Delicious.

The sharply rolling land and the poorly drained meadow furnish a large acreage of pasture. More than 60 per cent of the pasture land is sodded to bluegrass. Cattle are also grazed on the clover and the mixed clover and timothy after the hay is cut.

The raising and feeding of livestock holds a place of great importance in all parts of the county. The total value of domestic animals in 1924 was $5,400,298. The average number of cattle to the farm was nearly 22 head, of which about one-third were dairy cows. Many dual-purpose cows of the Shorthorn breed are milked. The purebred cattle are mainly of the Shorthorn and Holstein-Friesian breeds.

This county ranks high among Iowa counties in the number of dairy cows and value of dairy products. Butterfat is the principal product sold from the farms, and in 1924, 3,980,396 pounds were marketed. In the same year 305,556 gallons of whole milk were marketed, mainly at Strawberry Point.

This county also ranks among the first in the State in poultry raising. The average number of chickens to the farm is about 150. The flocks are largely mixed. Most of the eggs and poultry are handled through dealers in local towns. The census of 1925 reports 502,756 chickens, with a value of $422,315, raised in 1924.

Hogs are not kept in such numbers as in some counties of the State, the average to the farm being 25. The common breeds are Poland China, Duroc-Jersey, Chester White, and Hampshire. The hogs are pastured on clover and fattened on corn usually by hogging down. They are marketed at packing houses in Chicago, St. Paul, Cedar Rapids, and Dubuque.

The farm buildings are well constructed and well suited for their purpose. The dwellings in the more prosperous sections of the county are large, modern, and attractive. Most of the barns are modern, and many are designed and equipped for dairying.

The work animals consist mainly of heavy draft horses. The rolling relief of the land has discouraged the use of tractors over a

large part of the county. The implements and farm equipment are similar to those in use in other counties in this part of the State.

As a rule, systematic rotations are not followed, though their value is recognized. On many farms corn is grown from one to three years, followed by oats, with which clover and timothy mixed or clover alone is sown.

The land is handled in about the same way as in other counties in this part of the State. About half the land is fall plowed and half spring plowed. Oats stubble and clover and timothy sod are usually plowed under in the fall. Cornland is plowed in the fall, if possible, and otherwise is not broken until just before planting. When oats follow corn, the land is usually disked and the oats sown broadcast between April 1 and April 25. A considerable acreage of oats is drilled with clover. All available stable manure is applied on land for corn or is used as a top-dressing on clover or clover and timothy sod and plowed under.

The adaptation of the different soils to certain crops is recognized in a general way, but the distribution of these crops and the system of tillage are not greatly influenced by the soil type. Although it is recognized that corn does exceptionally well on certain soils, such as Tama silt loam, it is not grown only on these soils, since the system of agriculture practiced over the county calls for the growing of corn, small grain, and hay crops on all types of soil. On some of the bottom soils small grains are not grown extensively, as the plentiful supply of organic matter in these soils induces a rank growth of straw and the crop is likely to lodge.

The supply of farm labor fluctuates, but labor is usually abundant except in busier seasons. Wages range from $40 to $50 a month with board and washing for a single man. Married men have, in addition, the use of a house and garden and are allowed to keep a cow and poultry. Day laborers are paid from $2.50 to $3.50. During the season of 1925, 5 cents a bushel was paid for picking corn.

In 1925, 94.6 per cent of the total area of Clayton County was in farms. The average size of the farms was 150.3 acres, of which about two-thirds was improved. There has been no increase in the average size of farms during the last 15 years. Of the 3,069 farms in the county, 1,766 were operated by full owners, 342 by part owners, 11 by managers, and 950 by tenants. The percentage of tenancy has increased since 1910 from 22.1 per cent to 31 per cent.

About one-half the tenants pay cash rent, and the remainder pay a share of the crop or operate on a combined cash and share system. Cash rent for farming land ranges from $6 to $10 an acre. The usual arrangement with share tenants is that the tenant furnishes tools and work animals and receives one-half the produce. Farm contracts begin and end on March 1.

Since the decline of the boom prices that prevailed during and soon after the World War, comparatively little land has changed hands. The average value of farms, as given by the census of 1925, is $21,136, of which $18,211 is for land and buildings. Well-improved farms on good soils command $200 an acre. The prices of other farm lands range downward, according to the condition of the soil and improvements and distance from markets and roads, to about $90. Rough, untillable land may be sold as low as $30 an acre, but such land is usually sold with better land.

SOILS

The soils of Clayton County have been grouped in this report into a number of series and types on the basis of their physical characteristics and their chemical constitutents, as far as these could be readily ascertained in the field. The soils of any region owe their characteristics first to the character of the parent materials and second to the processes of soil formation, including weathering, leaching, aeration, and oxidation to which the soils have been subjected during their development. In this county the soil-forming processes, which are controlled to a large extent by climatic conditions, are believed to have been of greater influence in fixing the most important soil characteristics than the composition of the parent rock.

Clayton County lies in the prairie region of the United States where a temperate climate, smooth land surface, and a moderately plentiful supply of moisture have prevented the spread of forest over the greater part of the area and have favored the growth of a luxuriant grass vegetation. The most striking characteristic of the prairie soils and one common to all soils developed under a grass vegetation is a dark color. This color is imparted by finely divided carbonaceous material derived from the decay of grass roots. On areas of greater relief where drainage was more efficient, a forest growth had established itself by the time of the early settlements by white men. In the soils of such forested areas large quantities of organic matter have not accumulated, and the surface layer is light colored. The soils of the county may therefore be separated, on the basis of their most striking characteristic, into dark-colored and light-colored soils.

The dark-colored soils of the county fall into two major groups, the basis of differentiation being characteristics produced by different drainage conditions during the development of the soils.

The soils of one of these groups, of which the members of the Carrington series are representative, were developed under good drainage conditions. On smooth or gently rolling areas, where the soil-forming processes have acted without interruption, soils having certain common characteristics have been developed regardless of the parent material. A dark-colored surface layer reaches a depth of about 12 inches. In the virgin soils the upper 2-inch layer is loose or finely granular and is filled with grass roots forming a turf. Below this the material is distinctly granular, and grass roots are less abundant. The next lower layer, which is reached at a depth of 24 inches, is transitional between the dark-colored surface soil and the brown layer below. The dark color, which exists in black organic matter that has penetrated downward from the surface and formed a film over the granules, decreases downward through this layer, with the gradual thinning of the film. The texture of this layer is in most places heavier than that of the surface soil, being heavy silt loam or silty clay loam. Below it is yellowish-brown or brown silty clay, the zone of maximum clay concentration. In most places, particularly in the soils developed from loess, the heavy layer is not strongly developed. This layer may reach a depth varying from 30 to 36 inches. The next lower layer consists of the less altered parent material, which is commonly structureless and more friable than the material

above. In the Carrington soils, this material is glacial drift, typically clay loam or silty clay loam with a greater or less content of gravel and bowlders. In the Tama soils the parent material is a silty material known as loess. Spots and discolorations of red, gray, or yellow may occur at a depth of 5 feet, but these are a feature of the parent material and not characteristics developed in the soil. As a rule the carbonates in soils of this group are removed to a depth of several feet. This group includes, besides the Carrington soils, members of the Tama and Dodgeville series on the upland, of the Judson on the colluvial slopes, and of the Waukesha on the high terraces.

The soils of the second group of dark-colored soils have developed under the influence of excessive moisture. These soils have a black, finely granular surface layer which is generally underlain by a gray or mottled gray, yellow, and brown subsoil. The details of the profiles of these soils vary considerably, depending on the depth to which good drainage and oxidation have reached. Weathering under conditions of more or less deficient drainage has produced the Clyde, Cass, and Wabash soils. All these soils have been leached of their carbonates to a depth of more than 3 feet. The Clyde soils have resulted from the weathering of glacial drift in positions where drainage is deficient. The Cass and Wabash soils have developed over alluvial material deposited on the first bottoms.

The areas of light-colored soils are very nearly coextensive with the areas covered by forest when the county was first settled. These soils owe their principal characteristics to their development under a forest growth. The surface layer is gray or grayish brown and is from 3 to 8 inches thick. It is underlain by a grayish-brown or brown granular layer which varies with drainage conditions. In the Fayette and Lindley soils, the texture of this layer is only slightly heavier than of the layers above and below, and no compactness is seen. This layer in the Clinton soils is very compact in position, and a faint gray coating covers the granules. Below this layer, at a depth ranging from 24 to 30 inches below the surface, is the parent material from which the soils are derived. This is generally friable and has no definite structure. The color is brown or yellowish brown where the drainage is perfect and oxidation has been thorough. In this general group of light-colored soils belong the Clinton and Fayette soils of the upland, which have developed from loess, and the Lindley soils developed from glacial drift. The Bertrand and Plainfield soils occur on terraces and have developed from alluvial deposits. The Genesee and Sarpy soils of the first bottoms are also light colored, because the alluvial deposits giving rise to them were light colored and sufficient time has not elapsed since their deposition for any large amount of organic matter to accumulate.

In addition to the members of the soil series mentioned, three miscellaneous classes of material, muck, river wash, and rough stony land, are mapped.

The principal characteristics mentioned are those imparted to the soil by soil-forming processes such as leaching, oxidation, and the accumulation of organic matter. In the grouping of the soils into series, however, account has been taken of the composition, source, and processes of accumulation of the material from which the soils

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have developed. For instance, the soils of the Clinton series developed on loess are differentiated from the Lindley soils developed on the glacial drift and from the Bertrand soils of the alluvial terraces and the Sarpy and Genesee soils of the first bottoms.

In the following pages of this report the soils of Clayton County are described in detail and their relation to agriculture is discussed. The grouping of the soils into series is based on common details of the soil profile and the other characteristics described above. The subdivision of the series into soil types, the type being the unit of mapping, is based entirely on difference in the texture of the surface soil. The distribution of the various soils is shown on the soil map accompanying this report, and the acreage and proportionate extent of the soils is shown in Table 3.

TABLE 3.—*Acreage and proportionate extent of soils mapped in Clayton County, Iowa*

Type of soil	Acres	Per cent	Type of soil	Acres	Per cent
Tama silt loam	135,552	33.3	Wabash silt loam	13,696	4.6
Light-colored phase	31,808		Colluvial phase	9,664	
Fayette silt loam	140,160	28.8	Wabash loam	1,728	.3
Steep phase	4,352		Sogn loam	512	.1
Carrington loam	10,112	2.0	Sogn clay loam	768	.1
Carrington sandy loam	2,240	.4	Thurston sandy loam	128	.1
Clinton silt loam	50,816	12.6	Dubuque silt loam	768	.1
Steep phase	12,416		Davenport silty clay loam	64	.1
Lindley loam	4,864	1.0	Bertrand silt loam	2,304	.4
Lindley sandy loam	5,376	1.1	Millsdale loam	384	.1
Clyde silty clay loam	1,856	.4	Millsdale fine sandy loam	320	.1
Clyde silt loam	1,856	.4	O'Neill loam	832	.2
Dodgeville loam	1,536	.3	O'Neill sandy loam	1,920	.4
Judson silt loam	1,600	.3	Plainfield sandy loam	1,152	.2
Waukesha silt loam	2,816	.6	Sarpy very fine sandy loam	640	.1
Genesee silt loam	11,392	2.3	Muck	64	.1
Genesee very fine sandy loam	3,264	.7	River wash	6,784	1.3
Genesee silty clay loam	1,664	.3	Rough stony land	33,664	6.7
Cass silt loam	1,536	.3			
Cass sandy loam	1,152	.2	Total	501,760	

TAMA SILT LOAM

The surface soil of Tama silt loam, to an average depth of about 10 inches, consists of very dark grayish-brown silt loam which appears almost black when wet. The material is mellow and friable and breaks up readily into a granular condition. The soil granules are small, most of them being less than one-sixteenth inch in diameter, and some loose silt which has not entered into the soil grains is present. The surface material, to a depth of 2 inches, in the virgin soil is less perfectly granular and has a slightly grayer color than the remainder of the surface layer. This surface 2-inch layer is in most places filled with grass roots which form a sod and hold the fine granules in clusters. The surface horizon is underlain, to an average depth of about 22 inches, by heavy silt loam or silty clay loam which at a distance appears dark grayish brown but which on close examination proves not to be uniformly dark colored. The original color was brown, but the dark-colored organic matter has penetrated downward from the surface soil along cracks, root holes, and insect and worm burrows until the greater part of this horizon has been discolored. Worms, in a few places, also bring up lighter-colored soil

from below. Some of the foreign soil bodies, presumably the more recently formed, are distinct, but the older ones are gradually blended and intermixed with the surrounding soil. The soil when powdered is much browner than the average broken surface. The material of this layer is slightly more firm in position than is the surface soil but is friable and does not approach a hardpan or claypan condition. It breaks up to small clods larger than in the surface soil and very irregular in shape. This condition can hardly be considered as granular. In places, however, granulation is more distinct than in the surface soil and the granules are much larger, ranging from one-eighth to one-fourth inch in diameter.

The next lower layer or horizon consists of brown or yellowish-brown silty clay loam, heavier in texture than the material above. This material is slightly compact in position but is structureless and breaks up to irregular soft clods. A few dark streaks and stains resulting from organic matter which has penetrated from above are seen in this horizon, but they decrease rapidly with depth and do not modify the average brown color. A few iron stains and concretions may be seen. This horizon extends to a depth ranging from 30 to 36 inches but averaging 32 inches, and is underlain by similar material which is, however, slightly lighter textured, being more friable silty clay loam or heavy silt loam. This material has no definite structure. Iron stains and concretions become more numerous with depth, and at a depth of 4 or more feet faint gray mottles may be seen. No lime or other carbonates are present in any layer in sufficient quantity to react with acid.

Tama silt loam occupies the northern three-fifths of the county. It is the principal upland soil north of a line drawn through Guttenberg, Elkader, and Highland. In this region it covers the broad interstream divides and extends downward on the slopes except along the more deeply cut valleys. Small areas occur in other parts of the county on the smooth parts of the upland. The surface is undulating or gently rolling, except on some of the steeper stream slopes where it is moderately rolling. On account of the thinness of the loess covering over which the soil has developed no very deep erosion can take place without removing the soil entirely.

This is the most desirable farming soil in the county. Nearly every acre, unless it is rolling, is cultivated. This is an important corn soil in eastern Iowa, and in this county this crop holds first place in acreage. Oats and clover are also extensively grown. The success of these crops encourages dairying and livestock raising, which are very important. In the new part of the county some farmers practice a system of grain farming, devoting a large percentage of the land to corn. The usual yield of corn ranges from 35 to 50 bushels to the acre, but occasionally yields of 80 or 100 bushels are reported on some farms. Oats ordinarily yield from 30 to 60 bushels to the acre, depending on the season, and yields of 70 or 80 bushels are obtained in very favorable seasons. Dry weather near the time of maturity greatly decreases yields. Clover is sown with oats and is used for hay and pasture. From 1 to 3 tons to the acre of hay may be cut. Timothy is often sown with the clover. Some wheat is still sown, but the acreage seems to be decreasing. Small acreages of sweet-clover, alfalfa, and soybeans are grown.

This soil is easily prepared for seeding and can be kept in good tilth. Corn is usually followed by oats in which clover or clover and timothy is sown. After the oats are harvested, the clover is usually cut once, the land is pastured till early fall, and the residue is plowed under. Very little commercial fertilizer has been used on Tama silt loam. Some farmers have experimented with applications of superphosphate (acid phosphate) with very good results. Lime is usually used in small quantities to start clover, but liming is not necessary on all areas of the soil.

The value of Tama silt loam varies in different places, depending on the location with respect to towns, roads, and shipping points, from $125 to $200 an acre. In very favorable locations near towns the soil may be sold for $300 an acre.

No systematic efforts are being made to maintain the fertility of Tama silt loam. Constant cropping and gradual erosion of the surface soil will in time decrease yields, but so far the decrease in productiveness has not been sufficient to cause alarm or to lead the owners to adopt any conservation measures. Barnyard manure should be used on cornland and as a top-dressing for clover. The results with superphosphate indicate that this fertilizer could be used with profit. On slopes every precaution should be taken to prevent the removal of the soil by washing. Erosion of the surface by sheet wash usually is almost imperceptible but in time damage will be done. Small gullies should be stopped in the beginning, as they begin slowly but later wash out at an increasingly rapid rate.

Tama silt loam, light-colored phase.—The light-colored phase of Tama silt loam has a slightly lighter-colored surface soil than typical Tama silt loam but is very similar in texture, structure, succession of layers, and character of the parent material. The dark-colored surface layer is in most places about 16 inches thick. The underlying transitional layers, which range in color from very dark grayish brown to brown, reach a depth of 22 inches. Below this depth the thickness and character of the layers is essentially the same as in typical Tama silt loam. This phase of soil may be regarded as intermediate between the light-colored Fayette and Clinton soils and the dark-colored Tama silt loam. Fine gradations exist between these soils, and it necessarily follows that boundaries drawn on the map must be to some extent arbitrary.

This soil occurs in irregular strips between typical Tama silt loam and Fayette silt loam and also on flat divides within areas of Fayette silt loam and in low places in association with Clinton silt loam. An area of this soil several square miles in extent occurs along the north side of the railroad between Edgewood and Strawberry Point, bordering the areas of drift soil.

The surface features of this soil are similar to those of Tama silt loam, the relief being gently rolling or smooth. All the land is sufficiently well drained for the growing of staple crops. The slopes are not steep enough to be subject to serious erosion.

The greater part of this land was forested or at least supported a sparse growth of trees or underbrush at the time of settlement by white men. It is probable that the soil conditions are the result of development for a short time under a forest growth where timber had at comparatively recent times invaded the smooth upland.

The agricultural value of this land is very slightly lower than that of typical Tama silt loam, but a larger proportion of the land is tillable than of the light-colored soils of the more rolling areas.

Table 4 shows the results of mechanical analyses of samples of the surface soil, subsurface soil, and subsoil of typical Tama silt loam.

TABLE 4.—*Mechanical analyses of Tama silt loam*[1]

No.	Description	Fine gravel	Coarse sand	Medium sand	Fine sand	Very fine sand	Silt	Clay
		Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
336206	Surface soil, 0 to 12 inches	0.0	0.2	0.3	0.4	1.5	69.0	28.6
336207	Subsurface soil, 12 to 22 inches	.0	.2	.2	.3	1.9	65.8	31.8
336208	Subsoil, 22 to 40 inches	.0	.0	.1	.3	1.6	67.0	31.0

[1] After treatment with hydrogen peroxide.

FAYETTE SILT LOAM

The surface soil of Fayette silt loam, to an average depth of 5 inches, is grayish-brown or yellowish-brown smooth friable silt loam which when dry appears distinctly grayish. This layer is underlain to a depth ranging from 18 to 22 inches by yellowish-brown friable silt loam which differs little in texture and structure from the surface soil. The next lower layer, extending to a depth of about 40 inches, is light yellowish-brown or light-yellow silty clay loam which is firm in position but breaks up readily to irregular structure particles. Between depths of 40 and 66 inches is light-yellow silty clay loam faintly mottled with gray and slightly more friable than the layer above. The parent material of loessial silt lies in most places below a depth of 66 inches. It has a grayish-brown color faintly mottled with gray or brown spots and splotches, most of which are iron stains. Iron concretions are abundant in many places.

This soil occurs on slopes and rolling areas following the larger stream valleys. It has developed under the forest growth that has established itself on the rolling areas. It is very probable that the smooth original surface of this region was destroyed by erosion, which removed the black surface soil similar to that of Tama silt loam and the forest growth has not favored the formation of a new black surface soil. Therefore, Tama silt loam occupies the smooth tops of divides on the slopes of which are the Fayette soils. The principal areas of this soil occur in a broad belt following Turkey and Volga Rivers and their larger tributaries. The soil occurs not only on the steeper slopes but extends along narrow divides and some of the rounded knolls and ridges. Some of these areas are now cleared, but they were formerly forested. In a few places small or narrow marly flats are covered with this soil, marking areas where the forest encroached on the smooth upland and affected the character of the soil. The soil is very well drained, and in places drainage is excessive.

Fayette silt loam is an extensive soil and holds a high place in total production, although it is roughly estimated that only about 30 per

cent of its area is cultivated. A large part of the remainder is covered by a timber growth of oaks, ash, hickory, and other hardwood trees.

On the cultivated areas the principal crops are corn, oats, and clover. The acreage of corn is comparatively smaller than on Tama silt loam, as in many places the relief prevents the cultivation of corn for more than one year. Commonly corn is followed by oats and clover. In some places the clover is left for two years.

The yield of corn ranges from 20 to 50 bushels to the acre, with an average of about 30 bushels. Oats yield from 20 to 40 bushels, but the average is not more than 30 bushels. Clover yields about as well as on Tama silt loam, the yield ranging from 1 to 3 tons of hay to the acre.

Considerable care is required to prevent erosion on this soil. Contour plowing is rather generally practiced. Practically no commercial fertilizer and not a great amount of stable manure are used. Cattle are pastured for a considerable period on clover. The principal need of this soil is organic matter. The small amount of humus originally in the soil is gradually depleted or removed by erosion and a new supply is being added by plowing under clover and by adding small amounts of stable manure.

This soil commands from $90 to $150 an acre, depending on the relief and nearness to markets.

The addition of organic matter is the most practical way to improve production. The soil responds to an application of a phosphate.

Fayette silt loam, steep phase.—The steep, rolling, dissected areas of Fayette silt loam have been separated in mapping as Fayette silt loam, steep phase. The soil on these areas differs from typical Fayette silt loam only in the shallowness of the surface soil. This layer is everywhere shallow, but the thickness varies with the steepness of the slopes and the susceptibility to erosion. In places the grayish-brown surface soil has been entirely removed by erosion, and the yellowish-brown material is exposed on the surface. In other places the soil varies from a thin veneer to the thickness of the typical soil. The average thickness is probably about 4 inches. The lower layers are not essentially different from those of typical Fayette silt loam, except that the color resulting from oxidation is lighter yellowish brown.

The surface ranges from sharply rolling to very steep and almost precipitous, and drainage is good or excessive. The material erodes rapidly, and many gullies and ravines cross the soil.

Only a few very small patches of smoother land on talus slopes, which have been included with this soil in mapping, are cultivated. Some of the land is sparsely timbered and is used for pasture. The greater part of the forest, however, is that common to the slopes of the region, consisting mainly of oak, hickory, elm, ash, basswood, and other hardwoods.

Table 5 shows the results of mechanical analyses of samples of the surface soil, subsurface soil, and several layers of the subsoil of typical Fayette silt loam.

TABLE 5.—*Mechanical analyses of Fayette silt loam*[1]

No.	Description	Fine gravel	Coarse sand	Medium sand	Fine sand	Very fine sand	Silt	Clay
		Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
336201	Surface soil, 0 to 5 inches	0.3	0.5	0.2	0.4	3.1	71.2	24.2
336202	Subsurface soil, 5 to 22 inches	.1	.3	.2	.3	2.7	67.6	28.8
336203	Subsoil, 22 to 40 inches	.1	.3	.2	.4	2.6	66.4	30.0
336204	Subsoil, 40 to 60 inches	.0	.2	.2	.4	2.8	65.9	30.5
336205	Subsoil, 66 inches	.0	.0	.0	.3	1.5	69.6	28.7

[1] After treatment with hydrogen peroxide.

CARRINGTON LOAM

The surface soil of Carrington loam is very dark grayish-brown loam about 10 inches thick. To a depth of 3 or 4 inches, the virgin soil is filled with grass roots forming a turf. The material consists of fine soft granules to which the grass roots cling rather tenaciously. There is also some brown silty material among the granules. In the lower part of this layer, the grass roots are present but less abundant than in the upper part. The soil granules are more distinct and better formed and include the greater part of the soil material. The next lower layer, which reaches a depth of about 18 inches, is transitional in color between the surface soil and the brown layer below. The color changes downward from the very dark grayish brown of the immediate surface soil to brown in the lower part of this layer, which is distinctly granular, the granules being larger than in the surface soil. The darker color is owing to a coating on the surface of the granules. When these structure particles are crushed the color of the material is much lighter. The texture also becomes heavier in this layer, changing from loam to light clay loam. This layer is underlain to a depth of 36 inches by brown or yellowish-brown gravelly clay loam forming the heaviest layer developed in this soil. The next lower material is yellowish-brown clay loam which continues without much change to a depth of many feet. This is the glacial drift parent material. At a depth of several feet it may be splotched or variegated, depending largely on the color of the different rocks in the parent drift. Iron concretions and stains are abundant throughout the entire soil. Glacial gravel and scattered small bowlders may be found, but this coarse material makes up only a small percentage of the soil mass.

This soil occurs only in the extreme southwestern part of the county. It occupies smooth interstream divides. Drainage is good, and the surface is not sufficiently rolling to make the soil susceptible to rapid erosion.

Nearly all this soil has been brought under cultivation, but parts of nearly every farm are used only as pasture. The soil is not uniform in quality in all parts of its area. On account of its lack of uniformity it does not average so high in agricultural value as Tama silt loam, although some parts are fully equal to that soil in productiveness.

Dairying and cattle and hog feeding are important industries on this soil. Corn, the principal crop, is nearly all fed to livestock

on the farm. Yields of corn range from 30 to 45 bushels to the acre, but much higher yields may be obtained by good farmers on the best areas of this soil.

Oats is the crop next in importance. This crop is usually alternated with corn and occasionally clover and timothy are brought into the rotation, but the latter practice is not so general as in other parts of the county on account of the greater difficulty of establishing a stand of clover without liming. Crops of minor importance are millet, rye, and barley.

Manure is generally used on the land, and its beneficial effects are appreciated by the farmers. Fertilizers are not used for corn on this soil. Applications of lime are recommended, particularly if clover is to be grown.

Table 6 shows the results of mechanical analyses of samples of the surface soil, subsurface soil, and subsoil of Carrington loam.

TABLE 6.—*Mechanical analyses of Carrington loam*[1]

No.	Description	Fine gravel	Coarse sand	Medium sand	Fine sand	Very fine sand	Silt	Clay
		Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
336272	Surface soil, 0 to 10 inches	2.1	9.1	14.7	16.2	6.9	28.5	22.5
336273	Subsurface soil, 10 to 18 inches	3.3	8.7	12.2	15.0	7.2	27.7	25.8
336274	Subsoil, 18 to 40 inches	3.4	8.3	11.0	15.3	8.4	24.7	29.1

[1] After treatment with hydrogen peroxide.

CARRINGTON SANDY LOAM

Carrington sandy loam has a surface soil, about 10 inches thick, consisting of very dark grayish-brown or dark-brown friable sandy loam. This is underlain by sandy loam of similar texture, which continues to a depth of about 15 inches. The color changes downward in this material from the very dark grayish brown of the surface soil to yellowish brown. This layer is underlain by yellowish-brown sandy loam similar in texture to the layers above but lighter yellowish brown in color. A few scattered glacial gravel and small bowlders are found at all depths. The soil varies widely in texture in different places, the range being from sand to loam. These variations could not all be shown on the soil map on account of their small extent.

This soil occurs in a few comparatively small areas in the southwest part of the county within the drift-covered region. The surface features are similar to those of Carrington loam, the areas being gently rolling or almost flat. The topographic position and the porosity of the subsoil combine to insure good drainage. In dry seasons crops may suffer on the sandier areas.

This is a comparatively unimportant soil agriculturally, on account of its small total area. Practically all of it is under cultivation. The crops grown and the methods of management are the same as on Carrington loam. Crop yields, however, are somewhat lower than on the heavier soil. This soil is in need of organic matter, and the quantity of manure used at present does not seem sufficient to supply the needed humus. The soil is strongly acid, and liberal

applications of lime are necessary to remedy this condition. A good stand of clover can not be obtained unless the land is limed.

CLINTON SILT LOAM

The surface soil of Clinton silt loam, to an average depth of 7 inches, is grayish-brown silt loam. The structure is either single grained or imperfectly granular, the material commonly breaking up into small structure particles with much loose interstitial silt. The surface soil is underlain, to a depth of 12 inches, by brown silt loam which differs from the surface soil in its slightly lighter color and in having a more distinctly granular structure. The next lower layer is yellowish-brown heavy silt loam, more firm in position than the layer above and breaking up to a granular mass. The layer reaches a depth of about 20 inches and is underlain, to a depth of 28 inches, by light yellowish-brown silty clay loam which is heavier in texture than the layer above but no more compact. The next lower layer consists of yellowish-brown silty clay loam which breaks up into cubical clods which have a thin coating of gray on their surfaces.

Clinton silt loam varies rather widely, depending on relief and probably on a difference in parent material. The heavy layer is not so well developed as in some parts of the State and in places the very heavy layer is only faintly developed. The heavy layer also occurs at various depths; in places it is immediately below the surface soil whereas in other places it is 3 or more feet below the surface. This soil grades into Fayette silt loam, and a line between the two in many places is very difficult to draw. Small areas of Fayette silt loam occur throughout the areas mapped with Clinton silt loam. On account of the frequent change from one soil to the other and of their similarity it was not practical to separate all the small areas. Where erosion has been very rapid the heavy layer is exposed, usually in small areas on slopes or shoulders of ridges.

The largest areas of Clinton silt loam occur along the slopes to the Mississippi River. The soil occupies an irregular continuous strip, in places 6 or 8 miles wide, between the dark-colored prairie soil and the river bottoms. Other areas occur along the southern border of the county, but these are not well-developed Clinton silt loam and in their profiles very closely resemble Fayette silt loam.

The surface of Clinton silt loam is gently or sharply rolling. Drainage is everywhere adequate and in many places is excessive. A rather large acreage of the soil is under cultivation, though the proportion is not so large as of Fayette silt loam. The remainder is used for pasture and timberland. The principal crops are corn, oats, and clover. The system of farming and the distribution and rotation of crops are similar to those on Fayette silt loam. Orchards and vineyards are more common on this soil than on any other in the county. Plums, apples, pears, grapes, and cherries do well. Fruits are grown only for home use and local consumption. This soil seems especially adapted to strawberries and other berries, and these crops are rather generally grown. A heavy growth of hardwoods, including oaks, hickory, ash, basswood, and elm covers the forested areas.

The management of this soil with respect to crops, methods of cultivation, rotation, fertilizer, and yields is about the same as for Fayette silt loam.

On account of the larger proportion of sharply rolling land, the average value of this soil is slightly less than of Fayette silt loam, although the smooth areas command as high a price as any part of that soil. The price for farms consisting of this soil, including land of different kinds of relief, ranges from $75 to $150 an acre.

The most important need of this soil is the prevention of erosion. As on Fayette silt loam crops should be rotated and cultivated with this object in view. The soil is rather poor in organic matter, as is Fayette silt loam, and methods to supply this material should be similar to those practiced on that soil.

Clinton silt loam, steep phase.—Clinton silt loam, steep phase, differs from typical Clinton silt loam principally in its more sharply dissected surface and shallower surface soil. The soil varies greatly in thickness, depending on the slope of the land and its susceptibility to erosion, but the average thickness is about 4 inches. The color is similar to that of the typical soil. In many places a large percentage of very fine sand, which has probably washed from areas of sandstone exposures, is in the surface soil.

This phase of soil occurs in narrow areas on the steeper slopes along the Mississippi River and its larger tributaries. It lies below typical Clinton silt loam on the very steep slopes near the streams.

On account of its very rough, broken relief none of this soil is cultivated, with the exception of small patches on lower talus slopes. Nearly all the land is forested with the hardwoods common to the eroded areas of this county.

Table 7 shows the results of mechanical analyses of samples of the surface soil, subsurface soil, and two layers of the subsoil of Clinton silt loam.

TABLE 7.—*Mechanical analyses of Clinton silt loam*[1]

No.	Description	Fine gravel	Coarse sand	Medium sand	Fine sand	Very fine sand	Silt	Clay
		Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
336209	Surface soil, 0 to 8 inches	0.0	0.3	0.3	0.4	3.5	80.9	14.6
336210	Subsurface soil, 8 to 18 inches	.0	.4	.2	.3	2.4	76.2	20.5
336211	Subsoil, 18 to 24 inches	.0	.1	.1	.2	2.4	69.0	28.0
336212	Subsoil, 24 to 60 inches	.0	.1	.1	.3	2.9	68.0	28.6

[1] After treatment with hydrogen peroxide.

LINDLEY LOAM

The surface soil of Lindley loam is grayish-brown friable loam containing nearly enough silt to make the texture silt loam. The thickness of the soil varies with the relief but averages about 4 inches. This layer is underlain by yellowish-brown loam to a depth of 12 inches. The texture becomes gradually heavier downward through this layer, beneath which is gritty silty clay loam which continues to a depth of 34 inches. The underlying parent material is yellowish-brown silty clay loam or silty clay faintly mottled with gray and stained in a few places with iron. Coarser material, in-

cluding glacial gravel and small bowlders, is found locally in the upper layers of the soil but is more abundant in the parent material. The high content of silt in the surface soil in most areas is derived from silt loam washed down from the higher loessial soil areas. Included with this soil in mapping are areas of silt loam occurring where a mixture of silty material was washed down on the surface soil. The underlying layers in such areas are similar to those of typical Lindley loam.

This soil occurs in several areas on the slopes of the tributaries of Turkey and Volga Rivers, particularly along Hewett and Spring Creeks. The largest area is about one-half mile northwest of Strawberry Point. The other areas are small. The area northwest of Strawberry Point has a gently rolling surface, but the areas occupying the ridge shoulders and slopes are sharply rolling. Drainage is everywhere good or excessive.

This soil is not important agriculturally, and only a very small percentage of it is in cultivation. The greater part of the timbered land is covered by a growth of hardwoods including oaks, hickory, elms, and other trees.

This soil is very poor in organic matter. Any system of management designed for its improvement should include the incorporation of organic matter by the application of manure or by plowing under some legume.

LINDLEY SANDY LOAM

The surface soil of Lindley sandy loam, to an average depth of 15 inches, is grayish-brown sandy loam containing a large percentage of fine sand. In some places the upper 4-inch layer is slightly darkened by a small percentage of organic matter. The lower layer, to a depth of 20 inches, is light yellowish-brown sandy loam underlain, to a depth of 40 inches, by yellowish-brown sandy loam glacial drift parent material faintly colored with gray in places. This layer contains a small proportion of silt, small gravel, and rock fragments.

In sections 23, 24, and 25 of Boardman Township one-half mile east of Elkader some areas of sand have been included with this soil in mapping, on account of their small total area. To a depth of 5 inches this variation consists of light grayish-brown or yellowish-brown sand which is underlain, to a depth of 30 inches, by yellowish-brown uniform medium sand beneath which is slightly coarser sand. No gravel or coarse material occurs at any depth in this soil.

The largest development of this soil is along Maquoketa River in the southwest corner of Cass Township. Two areas occur along the Delaware County line in the same township. Numerous areas are scattered along Volga River, and a few are along Turkey River. The areas range from gently rolling to rolling. Drainage is good, and on account of the porosity of the subsoil crops may suffer in dry seasons.

This soil occupies a small area and is not important agriculturally. Corn is the principal crop. Yields are about the same as on Carrington sandy loam.

The greatest need of this soil is a larger supply of organic matter which may be obtained by applying barnyard manure or by turning under green-manure crops. Commercial fertilizers are not used at present, and it is not known whether their use would prove profitable.

Lindley sandy loam has about the same value as Carrington sandy loam but a lower value than Carrington loam. The selling prices probably range at present from $80 to $125 an acre.

CLYDE SILTY CLAY LOAM

The surface soil of Clyde silty clay loam, to a depth of 10 inches, consists of black silty clay loam which is underlain, to a depth of 20 inches, by dark grayish-brown silty clay loam, heavier in texture than the surface soil. This material is underlain by silty clay which contains some coarse sand and gravel. A few bowlders are scattered over the surface or through the soil. The surface, to a greater or less depth, may be covered by grayish-brown sediments mottled with gray and yellow, which have washed in from the higher lands. A few iron stains and concretions are found below a depth of 30 inches. The parent material was glacial drift, and it has weathered under conditions of imperfect drainage.

This soil occurs within the drift area in the southwestern corner of the county in flat or poorly drained areas at the heads of streams. These areas are in constructional valleys left by ice. The valleys were originally deeper, but they have been partly filled by sediments. These basinlike areas serve as drainage channels and branch much as do the stream valleys. Drainage was originally poor, and only a very small part of the soil has been reclaimed by artificial drainage.

This soil is of small importance agriculturally, both because of its small area and its limited agricultural utilization. With the exception of a few small strips along the edge of the areas, which are included within cultivated fields, the soil is used for pasture. The greater part of the land supports a growth of meadow grasses. As a rule it is used only for pasture, but hay is cut on a very small part of it.

An efficient system of drainage is necessary before this soil can be safely cultivated. Drainage is possible on practically all areas, but with land at the present price the cost is prohibitive over a large part of the soil.

CLYDE SILT LOAM

The surface soil of Clyde silt loam, to a depth of 15 inches, is very dark grayish-brown silt loam. This is underlain by dark-brown or almost black silty clay loam. Below a depth of about 21 inches is mottled gray, brown, and yellow clay loam. Some coarse sand and gravel occur throughout the soil, being more abundant in the two lower layers. This soil, like Clyde silty clay loam, has developed from glacial drift weathered under poor drainage conditions. Small areas of Clyde silty clay loam have been included in mapping.

This soil occurs in broad swales along drainage channels in a position similar to that of Clyde silty clay loam. The areas are narrow, and the soil is inextensive.

DODGEVILLE LOAM

Dodgeville loam, to an average depth of 10 inches, is dark grayish-brown or dark-brown loam. This is underlain by yellowish-brown

loam. Ordinarily at a depth ranging from 20 to 32 inches a limestone floor is found. In places, however, it was impossible to reach the rock within the 36-inch depth. There is considerable variation in texture, particularly in the surface layer which in small areas was sandy loam. In other small areas a high percentage of silt was mixed with the surface soil.

Included with this soil because of their small total area are patches of Gasconade loam. This included soil consists of dark grayish-brown loam or sandy loam 5 inches thick, underlain to a depth of about 10 or 12 inches by a soil of similar texture but grayish brown in color. These layers rest on impure limestone which outcrops in some places at the surface. Other variations were characterized by the presence of yellowish or reddish clay containing rock fragments between the surface soil layer and the bedrock.

This soil occurs only in Cass Township in the extreme southwest corner of the county, within the drift area. The main development is 1½ miles northwest of Strawberry Point. Small areas are scattered through and closely associated with Carrington loam. This soil is for the most part cultivated in connection with Carrington loam, and the agricultural methods employed and the crop needs are similar to those of that soil.

JUDSON SILT LOAM

The surface soil of Judson silt loam, to a depth of 18 inches, is mellow silt loam. The color is very dark grayish brown when the material is dry and almost black when it is wet. This layer is underlain by dark-brown smooth friable silt loam which becomes very slightly lighter colored with depth but in which little change in texture can be noticed. This soil has developed over colluvial deposits and may be regarded as an immature soil, as sufficient time has not elapsed since its deposition for the development of a well-marked profile.

This soil occurs in narrow strips, principally along Roberts Creek in the northwestern part of the county. Other small areas are along Turkey and Volga Rivers and Silver Creek. The soil occupies colluvial benches having a gentle slope toward the streams. The soil material has been washed down from higher areas of silty soils. Near the uplands these colluvial deposits may be several feet thick, but they gradually thin out on the flats toward the streams.

The greater part of this soil is well above overflow, but some of the lower slopes may be flooded for a short time in periods of exceptionally high water. Although the soil covers only a few square miles, it is important agriculturally, owing to its high productiveness. It has an ideal texture and a high content of organic matter. Drainage is perfect, and the soil is very retentive of moisture. Nearly every acre is in cultivation, principally to corn. Yields are as high as on the best areas of Tama silt loam. Oats and other small grains make good yields, and the soil is well adapted to alfalfa.

This soil occurs in such narrow strips that it does not constitute a large part of any farm. It is generally included with inferior soils. Its effect on any farm is to increase the general value.

WAUKESHA SILT LOAM

The surface soil of Waukesha silt loam is very dark grayish-brown silt loam 8 inches thick. This is underlain by brown or dark-brown friable silt loam which continues to a depth of 20 inches and gradually becomes heavier in texture downward. The next lower layer is yellowish-brown silty clay loam which extends to a depth of several feet. This soil resembles Tama silt loam in the character and arrangement of its layers.

Small areas of Waukesha loam have been included with this soil in mapping. This included soil differs from Waukesha silt loam only in the texture of the surface soil. The largest of the loam areas is about 1 mile northwest of Volga. Smaller areas are scattered along Volga and Turkey Rivers.

Waukesha silt loam occurs in several areas along Volga and Turkey Rivers and their tributaries. The largest area is 1 mile west of Volga. The soil occupies terraces standing from 10 to 30 feet above the flood plain. Owing to its position and the perviousness of the subsoil, it is well drained on the surface and internally but is very retentive of soil moisture.

Nearly all this soil is under cultivation to the crops common to the county. Corn is the most important crop, and oats are second in importance. Clover, timothy, rye, barley, and millet are also grown. Yields of all those crops are about the same as on Tama silt loam and the soil is managed much as is that soil. No commercial fertilizers and only a small amount of manure are used. The soil is not susceptible to washing, so no precaution is taken to prevent gullying.

This soil ranks among the most valuable in the county. It has about the same value as Tama silt loam but is in most places associated with soils of lower value. The occurrence of this soil on a farm always has the effect of increasing the valuation.

GENESEE SILT LOAM

The surface soil of Genesee silt loam, to an average depth of 18 inches, is smooth grayish-brown silt loam. This is underlain by heavy silt loam which continues to a depth of more than 40 inches. The color differs very little from that of the surface soil, except in places where it is slightly yellow. As is to be expected in a newly formed soil in a low position and subject to frequent floods, this soil has many variations. In places, it contains a considerable percentage of very fine sand or thin stratified layers of very fine sand, silt, or clay. Under a small part of the soil a dark heavy layer may occur below a depth of 24 inches.

This soil occurs in continuous strips along the smaller stream channels crossing the Fayette and Clinton soils. It occupies the lowest flood plains of the streams and is subject to frequent overflow. The soil drains rapidly after the recession of the floods and, with the exception of a few low basinlike depressions, is well drained.

Only a small part of this soil is used for cultivated crops, the remainder being used for pasture. Corn is grown almost exclusively. Yields are good in favorable years, but in some years the crop is cut short by late floods.

GENESEE VERY FINE SANDY LOAM

Genesee very fine sandy loam consists of light grayish-brown silty very fine sandy loam 15 inches thick, underlain by grayish-brown silty very fine sandy loam, slightly heavier in texture in most places than the surface soil. The soil is variable. The lower layers may be either lighter or heavier than the surface soil or there may be a succession of lighter or heavier layers. On account of its low topographic position, the soil is frequently flooded and changed by accessions of new river sediments.

The principal area of this soil begins on Turkey River, 2 miles east of Osterdock and extends along the river to its mouth. A few small areas occur along Elk Creek and Volga River. About one-half of the soil is in cultivation, almost exclusively to corn. Good yields are obtained in favorable years, but the average is cut by damage from floods.

GENESEE SILTY CLAY LOAM

The surface soil of Genesee silty clay loam, to an average depth of 7 inches, is grayish-brown silty clay loam. This is underlain, to a depth of 15 inches, by silty clay loam which is grayish brown mottled with rust-brown iron stains. The next lower layer is silty clay, more strongly discolored with rusty iron stains than the layer above. This layer continues to an average depth of 22 inches and is underlain by light slate-gray silty clay. Iron stains are much less numerous than in the layer above. The soil is not calcareous in any part.

This soil occupies low, poorly drained depressions near the streams. The principal areas are along Buck Creek near its mouth and on the Mississippi River bottoms northeast of Guttenberg and south of Turkey River. The areas south of Turkey River have a darker surface soil than is typical, but the subsoil is that of the typical Genesee soils. Water stands in ponds over the soil most of the year. Very little of the land is cultivated, the greater part being used for pasture.

CASS SILT LOAM

The surface soil of Cass silt loam is very dark grayish-brown or black heavy silt loam 15 inches thick. It has a finely granular structure, the granules being very irregular in size. The surface soil is underlain by imperfectly granular dark grayish-brown loam or fine sandy loam. At an average depth of 28 inches the fine soil layers are abruptly underlain by brown sand containing coarse sand, gravel, and small rock fragments. This material is open and porous.

This soil occurs in narrow strips in the flood plains of Turkey and Volga Rivers. It represents the lowest alluvial lands and has been built up by the most recent river deposits. The surface is in most places flat, but a few low ridges and mounds rise above the general level in some areas. The soil is subject to overflow at every rise of the river, but it drains rapidly after the water recedes.

A large part of this soil is in cultivation, almost exclusively to corn. Yields are good in favorable years, but the average for a series of years is cut by occasional years when floods cause yields to be low.

CASS SANDY LOAM

The surface soil of Cass sandy loam is very dark grayish-brown sandy loam 10 inches thick, which contains some coarse sand and fine gravel. This is underlain by brown coarse sandy loam which contains a large percentage of the coarser grades of sand and fine gravel. At a depth of 28 inches, a bed of very loose and porous coarse sand and gravel underlies the finer layers. There is considerable variation in the bottom of the surface soil, but the lower gravel remains uniform.

Included with this soil in mapping is a finer-textured variation which occurs in Marion and Highland Townships in areas too small to be indicated separately on the soil map. This included soil is very dark grayish-brown fine sandy loam from 12 to 14 inches thick. It contains considerable silt. Underlying this is grayish-brown or brown fine sandy loam containing more coarse sand and scattered gravel. This soil is slightly less inclined to be affected by drought than typical Cass sandy loam. The texture averages fine sandy, but many spots are loam.

This soil occurs in the first bottoms of Volga and Turkey Rivers. The largest development is near the point where Turkey River enters Clayton County. The soil occupies low areas and is subject to overflow at every rise of the river.

The greater part of the principal areas of this soil is in cultivation. Corn is the principal crop, but small grains are occasionally grown. In very favorable seasons yields are satisfactory, but the average is cut by failure caused by flooding.

WABASH SILT LOAM

The surface soil of Wabash silt loam, to an average depth of 12 inches, is very dark grayish-brown or black friable silt loam. This is underlain by brown silty clay loam which in turn is underlain, at a depth of 20 inches, by grayish-brown silty clay loam. A few faint iron stains occur in some places.

This soil occurs along the small streams that flow across the areas of dark-colored loessial soils. It occupies the immediate flood plains, rising above the stream level to a height of several feet. It is all subject to overflow at every rise of the stream. Drainage is good, and the water is removed from the land very soon after the floods subside. A very few areas occupy basinlike depressions where drainage is deficient.

The greater part of this soil is used for pasture, not because it is not suited for cultivation but because it occurs on farms where upland soils are used for cultivated crops. The cultivated areas are excellent cornland, and corn is the principal crop grown. Yields are as large as on any soil of the county.

Wabash silt loam, colluvial phase.—The surface soil of Wabash silt loam, colluvial phase, is very dark grayish-brown silt loam which ranges in thickness from 12 to 20 inches. This is underlain by brown or dark grayish-brown heavy silt loam which continues to a depth of more than 40 inches. In places along the upper reaches of the smaller streams, where silty material has been continually added as a colluvial deposit over the surface, there is no appreciable

difference in the soil to a depth of 3 or more feet. In such areas the soil resembles Judson silt loam. The greater part of the land is subject to overflow, but the floods subside quickly, and the excess water is soon removed.

In the eastern part of the county about 3 miles east of Garnavillo small areas of this soil contain some rock fragments. Here the soil material is composed partly of wash from black residual soils, and some of the limestone fragments have also been brought down the slopes and incorporated with the colluvial material. These areas are small and unimportant.

A large part of this soil is under cultivation, and the remainder is used for pasture. This is an excellent corn soil, fully equal to Tama silt loam of the uplands. It is cultivated in connection with that soil, agricultural methods used are similar, and crop yields are about the same.

WABASH LOAM

Wabash loam consists of very dark grayish-brown friable loam 18 inches thick, underlain by dark grayish-brown or brown clay loam containing considerable of the coarser grades of sand. A fine sandy loam phase of the soil is found in very small areas along Maquoketa River in the southwestern corner of the county. These differ from typical only in the fine sandy loam texture of the surface soil.

This soil occurs in very small areas along Turkey and Volga Rivers and a few of their tributaries and on tributaries of Maquoketa River in the southwestern corner of the county. It occupies the lower flood plains and is subject to overflow at frequent intervals. Very little of the soil is cultivated, the greater part being used as pasture land.

SOGN LOAM

The surface soil of Sogn loam, to a depth of 10 inches, is rich-black loam containing much coarse sand and clay. Below this, to a depth of 15 inches, is dark-brown or black silty clay loam or silty clay abruptly underlain by pale grayish-yellow clay loam containing considerable coarse sand. This in turn is underlain, at a depth of 24 inches, by heavy, tough, residual blue-gray silty clay or clay beneath which is hard limestone.

This soil occurs only in a few small areas, principally in sections 13, 14, and 23 of Sperry Township, in the southwestern part of the county, and along the road leading from Strawberry Point to Elkader, from 3 to 5 miles southwest of Osborne.

The areas of Sogn loam are eroded to some extent, and the surface is gently rolling. The soil is naturally productive. It has a high content of organic matter, and the subsoil is fairly rich in lime. All crops common to the region are grown. Yields compare favorably with those obtained on Carrington loam.

SOGN CLAY LOAM

The surface soil of Sogn clay loam consists of black heavy clay loam about 7 inches in thickness. The sand present is rather coarse. Below this is black calcareous silty clay or clay. At a depth of 12

inches, this is abruptly underlain by heavy bluish-gray clay faintly mottled with yellowish brown. This clay rests on the limestone bed from which the soil is derived. The depth of soil above the limestone varies, and in many places the rock is exposed in small patches. The surface soil is moderately calcareous, and the layers below have a high lime content.

A brown residual soil has been included on the soil map with Sogn clay loam. This variation consists of brown clay loam 5 inches thick, underlain by yellowish-brown tough clay which rests directly on the limestone at a depth ranging from 12 to 15 inches. The surface soil is moderately and the subsoil highly calcareous. A black surface soil has either never developed or has been removed by erosion. This soil covers only a small total area and could not well be separated on the soil map. Several small areas of this variation are in the west-central part of the county near Turkey and Volga Rivers. One of the largest areas is 3 miles northwest of Elkader, others occur one-half mile south of Osborne, 2 miles west of Osborne, and scattered over the same general region along Volga River.

Sogn clay loam is inextensive in Clayton County. An area near Turkey River lies on a benchlike position and has a flat surface. The other areas are more rolling. The soil on flat areas is poorly drained externally and internally. Other areas have sufficient slope to provide run-off, but the imperviousness of the subsoil restricts internal drainage.

The low-lying areas are in cultivation to the crops common to the county. Corn and small grains give good yields in seasons of well-distributed rainfall, but in wet seasons the returns are low. Corn yields from 30 to 50 bushels to the acre and oats from 20 to 40 bushels. Clover and timothy thrive on the better-drained areas. The land requires careful drainage to remove the excess seepage and surface water.

THURSTON SANDY LOAM

Thurston sandy loam, to a depth of 5 inches, consists of dark grayish-brown sandy loam underlain, to a depth of 22 inches, by brown sandy loam interspersed with scattered gravel. Below this is coarse sandy gravel continuous to a depth of several feet. The parent material over which this soil has developed is coarse glacial drift. The porosity of the material has prevented the development of a deep dark-colored surface soil.

Only a few small areas of this soil have been mapped in this county. These are all in the drift region of Cass Township in sections 5, 6, 24, 25, 28, 31, and 33. On account of its porosity and droughtiness, this soil gives low yields and has a low agricultural value.

DUBUQUE SILT LOAM

Dubuque silt loam consists of grayish-brown mellow silt loam underlain by yellowish-brown silty clay loam beneath which is yellowish-brown or reddish moderately stiff gravelly clay. This in turn rests on limestone. The total thickness of this soil above bedrock ranges from 6 to 30 inches. The surface soil is developed largely or entirely from loess and the underlying clay is residual from limestone, but in places the loessial soil rests directly on the rock at a slight depth.

This soil occurs on steep slopes or edges of the bluffs along the larger streams in places where the covering of loess has been removed by erosion or was originally thin. From the nature of the relief and the origin of the soil, variations in the color of the surface soil and the textures of the various layers is to be expected.

On account of the unfavorable relief very little of this soil has been cultivated. All of it was formerly covered with a growth of oaks, hickory, elm, and walnut. The smoother areas can be most profitably utilized for pasture and the rougher areas for forestry.

DAVENPORT SILTY CLAY LOAM

The surface soil of Davenport silty clay loam, to an average depth of 6 inches, is grayish-brown or brown plastic clay loam. It is underlain, to a depth of 22 inches, by light-brown silty clay or clay having a distinctly pinkish hue under normal field conditions. Below this layer is pinkish-brown or reddish-brown tenacious clay containing faint brown or gray mottles. The coloration is due to the parent material and not to poor drainage.

A few small areas of this soil occur on benches of Buck Creek near its mouth. A part of the soil is cultivated. Corn is the principal crop, and fair yields are obtained. On account of its small total extent, this soil is of little agricultural importance.

BERTRAND SILT LOAM

The surface soil of Bertrand silt loam consists of grayish-brown silt loam continuing to a depth of about 18 inches without any marked change in texture. This layer is underlain by yellowish-brown friable silty clay loam containing some very fine sandy loam. In position this material is firm or slightly compact. It breaks up into small irregular clods. In a few places, as in an area 3 miles northwest of Volga, the subsoil is heavy and plastic.

This soil occurs in a number of very small areas along Volga and Turkey Rivers and their tributaries. It occupies terraces standing about 10 feet above the flood plains. It developed on alluvial material over which some colluvial sediment has been spread. The colluvial material is light colored, having been brought down from the higher areas of light-colored soils. The surface is flat or very gently sloping toward the streams. On account of its elevated position, the soil is well drained.

Nearly all this soil is in cultivation. The crops common to this county are grown in about the same rotation as prevails on the upland. Crop yields compare favorably with those obtained on Fayette silt loam and Clinton silt loam. Corn yields in different years range from 25 to 50 bushels to the acre. Oats produce from 20 to 40 bushels to the acre.

The methods of supplying needed organic matter are the same as those recommended for the Clinton and Fayette soils.

MILLSDALE LOAM

The surface soil of Millsdale loam, to an average depth of 15 inches, is dark grayish-brown heavy loam which breaks up into very

fine but distinct granules. This layer is underlain by heavy clay loam. When wet the soil has a gritty feel, owing to the presence of a small percentage of medium or coarse sand. The granular structure is very distinct, the granules being larger than are those of the surface soil. When the granules are crushed the resulting material is lighter in color, showing that the color is only a coating on the surface of the granules. This material continues to limestone bed rock, which is reached at a depth ranging from 32 to 40 inches.

This soil occurs in several small areas along Volga River between the towns of Osborne and Volga. It occupies high benches which have been formed by erosion rather than deposition. The surface soil is derived wholly or in part from glacial drift, but the lower part of the soil is derived entirely from the limestone. It is difficult to determine what part is glacial and what part residual, as the weathered products of these materials are very similar and in most places are intermixed.

Nearly all this soil is under cultivation, to the crops common to the county. Yields are similar to those obtained on the other dark-colored soils, such as Carrington loam. The surface soil is not rich in lime, but the subsoil in places is moderately calcareous.

In agricultural value this soil ranks with the other dark-colored upland soils, and its selling price is about the same as that of the Carrington and Tama soils in similar situations.

MILLSDALE FINE SANDY LOAM

Millsdale fine sandy loam is similar to Millsdale loam, except in the texture of the upper layer. The soil to a depth of 10 inches is dark grayish-brown fine sandy loam having a fine granular structure. This is underlain, to a depth of 22 inches, by fine sandy loam having a very slightly browner color but otherwise being similar to the surface soil. The next lower layer is brown or dark-brown clay loam containing much fine sand. The limestone lies at varying depths, but the average depth is about 30 inches.

This soil is inextensive. It occupies the higher parts of terraces above the areas of Millsdale loam. The surface is gently undulating, and drainage is well established. Several small areas are along Volga River between the towns of Osborne and Volga. All the soil is cultivated. Yields are slightly less than on Millsdale loam and about the same as on Carrington sandy loam.

O'NEILL LOAM

The surface soil of O'Neill loam, to an average depth of 12 inches, is dark grayish-brown loam containing considerable coarse sand and gravel. This is underlain, to a depth of 20 inches, by brown fine sandy loam which in turn is underlain by light-brown sandy gravel.

This soil occurs in a number of small areas on the terraces of Volga and Turkey Rivers and their tributaries. The surface is flat. Drainage, owing to the topographic position and the porosity of the subsoil, is excessive, and crops suffer in dry seasons.

This soil is nearly all in cultivation. The crops common to the region are grown. Average yields are greatly reduced by drought. The soil as a whole has a low agricultural value.

O'NEILL SANDY LOAM

The surface soil of O'Neill sandy loam, to an average depth of 12 inches, is dark-brown sandy loam containing scattered small gravel and small amounts of coarse sand. This is underlain, to a depth of 24 inches, by light-brown coarse sandy loam. The next lower layer is a gravel substratum which continues to a depth of several feet.

This soil occurs in small areas on terraces above Turkey and Volga Rivers and their tributaries. On account of the terrace position and the porosity of the subsoil, the areas are very droughty and yields are greatly reduced in seasons of deficient rainfall. Yields are slightly lower on an average than on O'Neill loam.

On account of its droughtiness this soil has a low agricultural value.

PLAINFIELD SANDY LOAM

Plainfield sandy loam consists of light grayish-brown sandy loam underlain, at an average depth of 12 inches, by slightly lighter-colored sandy loam which contains coarse sand and fine gravel. The subsoil is loose and not retentive of moisture. Several variations are present. In places the surface soil is heavier in texture, approaching loam, and other areas contain a large proportion of loam derived from colluvial sediments brought down from the higher land.

This soil occurs in very small areas on terraces, principally near the junction of Turkey and Volga Rivers. One area is in the town of Volga and another, larger area is 1 mile northwest of that town. The other areas are small.

The terraces on which this soil occurs stand well above the streams. On account of the elevated position of the soil and the looseness and porosity of its subsoil, drainage is rapid, and crops suffer in long periods of low rainfall.

Nearly all this soil is cultivated. The crops common to the county are grown. Yields average lower than on the heavier light-colored soils.

The greatest need of this soil is organic matter, which may best be supplied by the use of stable manure.

SARPY VERY FINE SANDY LOAM

Sarpy very fine sandy loam consists of grayish-brown very fine sandy loam 15 inches thick, underlain by grayish-brown very fine sandy loam or fine sand. The surface soil and subsoil contain some silt, the quantity decreasing with depth. On account of the manner in which the soil was deposited, many variations may be found, and in places thin layers of varying texture make up the entire soil. A sandy phase is found in a few small areas northeast of Volga. On account of its small total acreage it has been included in mapping with Sarpy very fine sandy loam.

Small areas of this soil are along upper Turkey River and upper Volga River, the largest being one-half mile northeast of Volga. The soil occupies the lowest flood plains bordering the stream channels and is subject to periodic overflow.

Only a small part of this soil is cultivated. Corn is the main crop. Yields are fair in good years, but the average is cut down by the damage sustained from floods.

MUCK

A few very small areas of muck occur in the southwest corner of the county, southeast of Strawberry Point. Muck consists of dark-brown or black partly decomposed vegetable matter derived from an accumulation of the remains of plants mixed with varying amounts of mineral matter washed in from the surrounding uplands. The material in most places ranges in thickness from a few inches to 3 feet. The areas are poorly drained. None of the material is cultivated, being used only for pasture.

RIVER WASH

Small areas of river wash have been mapped along the Mississippi River in the eastern part of the county. This material, which can hardly be regarded as a soil, consists of recently deposited sediments, mostly unassorted. It may be composed of a heterogeneous mixture of both coarse and fine materials; in one place it may make up a sand bar and in another a mud bank. These deposits are reworked in every period of high water, and the areas are subject to change of outline or even total removal by any flood. The land has little agricultural value. A few trees, mostly willows, are scattered over the more permanent areas, and a sparse growth of grass has established itself on some of the better soil material.

ROUGH STONY LAND

Rough stony land is a nonagricultural class of land of little value even for grazing. It occurs on steep slopes where the streams have removed the greater part of the loess, and the underlying limestone or the soil weathered from it is exposed. This classification includes the almost perpendicular limestone ledges common along the large streams. These limestone ledges are indicated on the soil map by rock outcrop symbols.

The thin residual soil which overlies the rock over a considerable part of these areas is weathered from the limestone. It consists of black heavy silt loam 3 inches thick and is underlain by a thin layer of black silty clay which in turn is underlain by gray or gray and brown mottled clay, which rests on the rock. This material may be 3 inches or more in thickness, but as a rule the entire thickness of the weathered soil is only a few inches. The thickness depends on the slope; on lower slopes the deeper soil consists of material which slides down from above. In places, silty material has been washed down from the loess soils and forms a thin covering over the rocks or the residual soil. In small areas the silty material is very similar to that on the steep areas of the Fayette and Clinton silt loams. Such areas were, however, too small to indicate on the soil map.

A growth of timber is found over the greater part of this land where a soil covering exists. The tree growth consists of oaks, hickory, elm, ash, birch, and other hardwoods, and patches of underbrush.

The trees are for the most part of sufficient size to be of economic value.

As the roughness and stoniness of this land prevents its being used for cultivated crops, it seems that the best use for it is for growing timber.

SUMMARY

Clayton County is in the northeastern part of Iowa. Mississippi River forms its eastern boundary. The total land area is 784 square miles.

The county has two main topographic divisions. In the first, which includes the entire county except a small area in the southwestern part, the surface features result from severe erosion. This division includes the eroded driftless area, the eroded area thinly covered by the Kansan drift, and the excessively eroded river valleys. The second division comprises the smooth constructional Iowan drift plain of the southwestern part of the county.

The agricultural development of the county began about 1830. The county now has a population of 25,032.

The climate is favorable for the safe production of all the staple crops of the region. The mean annual precipitation is 34.36 inches.

The prevailing type of agriculture in the county combines the raising of grain and hay and the raising and feeding of livestock. Corn is the principal crop, and the agricultural system is based on its production. The raising and feeding of livestock are of great importance in all parts of the county.

The soils of the county may be broadly divided into two groups, the dark-colored soils of the smooth prairies and alluvial lands and the light-colored soils of the forested upland slopes.

The soils were grouped on the basis of their important characteristics into 21 series represented by 31 soil types and 4 phases and 3 miscellaneous classes of material, rough stony land, muck, and river wash.

The dark-colored well-drained upland soils are represented by members of the Carrington and Thurston series developed over glacial drift, the Tama series developed over loess, and the Dodgeville and Sogn series over limestone. The Millsdale, Waukesha, and O'Neill series comprise dark-colored well-drained soils of the higher terraces.

The soils of the Clyde, Cass, and Wabash series are dark-colored soils developed under conditions of excessive moisture. They have black surface layers and gray or mottled subsoils. The Clyde soils result from the weathering of glacial drift. The Wabash soils are first-bottom soils having heavy subsoils, and the Cass soils have loose sandy subsoils.

The light-colored loessial soils of the Fayette series have mellow friable subsoils and of the Clinton series have heavy subsoils. The Lindley soils developed over glacial drift. The Bertrand and Plainfield soils are light-colored soils of the terraces. The Sarpy and Genesee soils are newly laid light-colored soils of the first bottoms.

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[PUBLIC RESOLUTION—No. 9.]

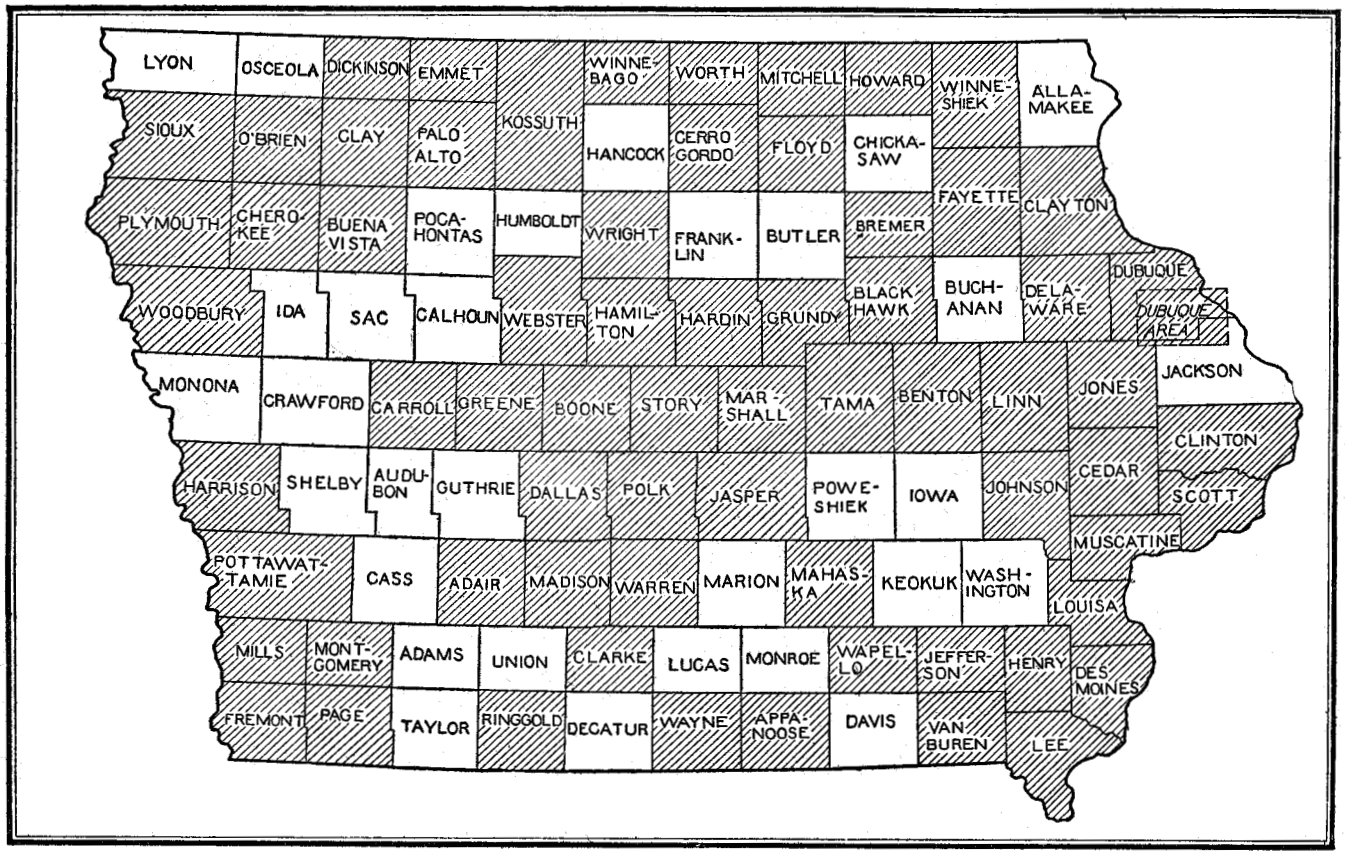
JOINT RESOLUTION Amending public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, "providing for the printing annually of the report on field operations of the Division of Soils, Department of Agriculture."

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, be amended by striking out all after the resolving clause and inserting in lieu thereof the following:

That there shall be printed ten thousand five hundred copies of the report on field operations of the Division of Soils, Department of Agriculture, of which one thousand five hundred copies shall be for the use of the Senate, three thousand copies for the use of the House of Representatives, and six thousand copies for the use of the Department of Agriculture: *Provided*, That in addition to the number of copies above provided for there shall be printed, as soon as the manuscript can be prepared, with the necessary maps and illustrations to accompany it, a report on each area surveyed, in the form of advance sheets, bound in paper covers, of which five hundred copies shall be for the use of each Senator from the State, two thousand copies for the use of each Representative for the congressional district or districts in which the survey is made, and one thousand copies for the use of the Department of Agriculture.

Approved, March 14, 1904.

[On July 1, 1901, the Division of Soils was reorganized as the Bureau of Soils.]



Areas surveyed in Iowa, shown by shading

U. S. GOVERNMENT PRINTING OFFICE: 1930

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